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Introduction

Conceptual modeling is the process of building a representation of selected phenomena in a problem domain for the purpose of understanding and communication among stakeholders (Wand and Weber 2002) in the process of information systems analysis and design. A crucial element in the context of conceptual modeling is the 'conceptual modeling grammar', i.e., the set of (graphical) constructs and the rules that show how to combine the constructs for modeling real-world domains (Wand and Weber 2002).

In line with the reported popularity of conceptual modeling and despite an observable proliferation of modeling grammars, only a few have been widely accepted by practitioner communities. While IS research has shown that modeling grammars differ quite significantly in their features and characteristics, e.g., correctness and ease of use (Batra et al. 1990) or support for domain comprehension and problem solving tasks (Agarwal et al. 1996), actual practice informs us that, seemingly independent from such intrinsic characteristics, certain modeling grammars have achieved higher levels of adoption and dissemination in modeling practice than others. Hence it appears that the findings from prior IS studies provide only little explanation of actual acceptance and usage patterns. Acceptance and usage studies are quite popular in IS research in general (Davis 1989; Bhattacherjee 2001b) but the question of the *continuance decision*, viz., the decision of an individual to continue using an artifact (Bhattacherjee 2001b), has only to a small extent been addressed in the modeling community.

Accordingly, the *imperative of this research* is to develop an understanding of the continued use of modeling grammars by individual modelers after its initial adoption. This focus of the study can be justified in referral to the observation that, often, the initial adoption of a modeling grammar is an organizational decision. Yet, prior studies, e.g., (Brown et al. 2002), have

suggested that individual acceptance in the post-adoption phase would have significant implications for the long-term viability and eventual success of modeling grammars.

In particular, this study seeks to explore whether certain intrinsic characteristics of modeling grammars, such as their capabilities to provide faithful representations of real-world domains (Wand and Weber 1993), pose an impact on an individual's intention to continue using a modeling grammar. The unit of analysis in this study is the 'conceptual modeling grammar', following the definition presented above. The ultimate dependent variable of interest is the 'intention to continue to use' (Bhattacherjee 2001b), and as independent variables the 'representational capabilities' of conceptual modeling grammars (Wand and Weber 1993; Weber 1997) are studied.

The study design employs multiple research methods, in particular semi-structured interviews as part of case studies (to explore the independent variables, i.e., to build the model), and surveys (to measure the effect of these variables on the dependent variables, i.e., to test the model). The remainder of this paper is as follows. The next sections describe research model and empirical study design. Then, the contributions to-date are described and a discussion of study limitations is given.

Research Model

An a-priori model of grammar acceptance was finalized after conduct of literature review and semi-structured interviews as part of six case studies. The predominant objective of the model-building exercise was to converge existing continuance and acceptance theories (Davis 1989; Bhattacherjee 2001b) in the context of conceptual modeling, whilst also taking into consideration further endogenous variables that may pose a contingency effect on the construct relationships. Figure 1 gives the model, the constructs of which are explained in more detail below.

Dependent Variables

The ultimate leading question of this research is to explain the intention of an individual to *continue to use* a conceptual modeling grammar. Two theories are dominant in IS research when it comes to studying continued acceptance and usage behavior, viz., the technology acceptance model (TAM) and Expectations-confirmation theory (ECT). TAM has been identified as a most influential and commonly employed theoretical framework (Lee et al. 2003) in this context while ECT denotes a more recent theoretical model that specifically focuses continued usage scenarios.

The technology acceptance model (TAM) (Davis 1989; 1993) postulates (and has shown) that when users are presented with an IS artifact two primary factors influence their decision about how and when they will use it. *Perceived usefulness* (PU) is the degree to which a person believes that using a particular artifact would enhance his or her job performance while *perceived ease of use* (PEOU) constitutes the degree to which a person believes that using a particular artifact would be free from effort.

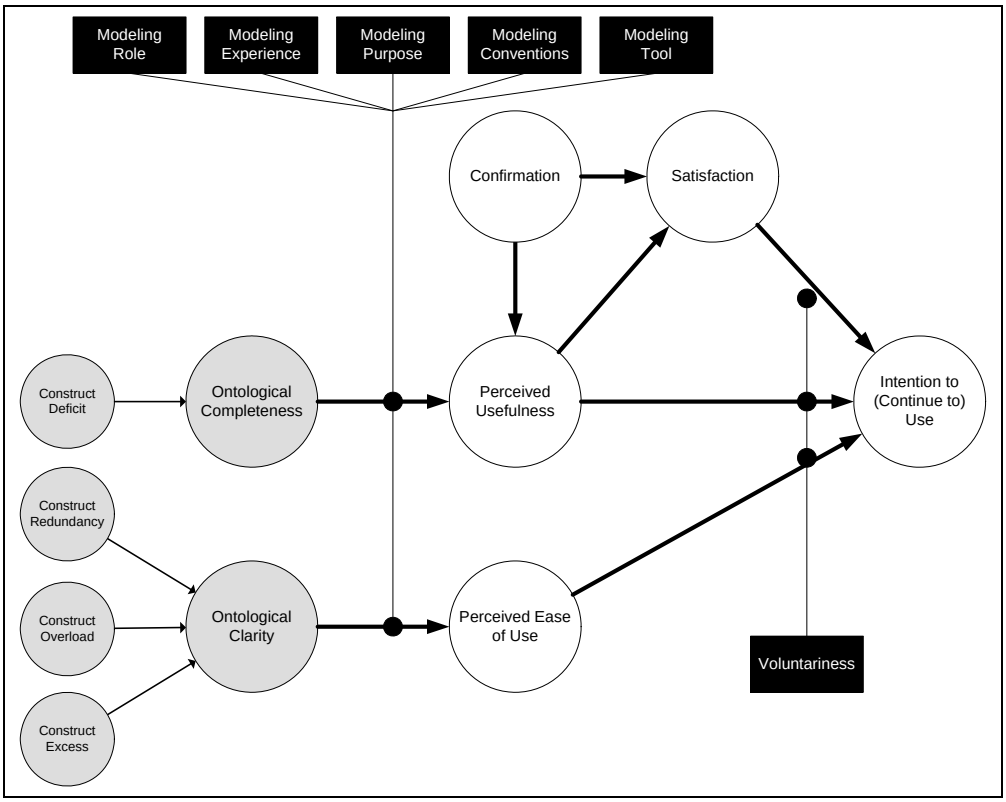

Figure 1: Research model

TAM does not explicitly include measurements for post-adoption behavior that arises out of users' direct first-hand experience with the target artifact. Expectations-confirmation theory (ECT) (Bhattacherjee 2001b; 2001a), on the other hand, posits that initial pre-usage expectations, coupled with perceived performance, lead to post-adoption *satisfaction*, which in turn determines the formation of the intent to continue using the artifact under observation. This effect is mediated through positive or negative *confirmation* between the expectations and the perceived performance. If an artifact outperforms expectations (positive confirmation) post-adoption satisfaction will result. If an artifact falls short of expectations (negative confirmation) the user is likely to be dissatisfied.

Independent Variables

This study theorizes a causal relationship between the continuance intention and intrinsic characteristics of modeling grammars. As surrogates for these intrinsic characteristics, the notions of *ontological completeness* and *ontological clarity* from representation theory (Wand and Weber 1990; 1993; 1995; Weber 1997) have been selected. Representation theory is a well-established framework in conceptual modeling for establishing strengths and weaknesses of, and differences between, conceptual modeling grammars (Green and Rosemann 2004). It posits that conceptual modeling grammar should not exhibit a deficit of representations that are needed to articulate all relevant facets of real-world phenomena that a user seeks to have represented. This principle is known as *ontological completeness* and is indicated in any grammar by the extent of construct deficit it exhibits. Representation theory furthermore posits that conceptual modeling grammars should also be *clear*, *viz*., they should provide representations for all relevant facets of real-world phenomena in such a way that the meaning of these representations can unambiguously be interpreted. Wand and Weber labeled this principle *ontological clarity* and continue to elaborate that ontological clarity in a grammar is negatively affected by three situations, viz., construct redundancy, construct overload and construct excess. Construct redundancy exists when two or more language constructs in a grammar share the capacity to model the same real-world phenomenon. Construct overload exists when a language construct in a grammar has the capacity to represent more than one real-world phenomenon. Lastly, construct excess exists when a language construct in a grammar does not have the capacity to model any relevant aspect of a real-world domain.

Given that ontological completeness and clarity have in several instances been shown to affect the quality of modeling e.g., (Bodart et al. 2001; 2002; 2004; Gemino and Wand 2005; Bowen et al. 2006), it is likely that they will also impact the intention to continue using modeling grammars. This argument rests on the assumption that modelers would avoid grammars that do not exhibit adequate levels of completeness and clarity. After all, they would not be able to capture all of the phenomena they require to have articulated in their models.

Moderating Variables

Six distinct contextual factors have been identified that potentially pose a contingency effect on the decision to continue to use a conceptual modeling grammar and which thus are included in the model (see Table 1).

Table 1. Moderating Variables

Construct	Rationale
Modeling Role	Green and Rosemann (2000) identified the modeling role (e.g., business analyst, technical analyst), that a modeling subject occupies in the referred modeling initiative, as a moderating variable relevant to user evaluations.
Modeling Experience	Modeling experience was found in an empirical study by Davies et al. (2004) to further explain some of the variances between responses for user evaluations.
Modeling Purpose	Modeling purpose was hypothesized by Rosemann and Green (2006) to also moderate the perceived criticality of representational deficiencies. Davies et al. (2006) found empirical

	evidence for this proposition.
Modeling Tool	Recker et al. (Moore and Benbasat 1991) found that the use of certain modeling tools may help to overcome some weaknesses in modeling grammars, as some tools provide additional support for modeling activities such as meta-tags and model decomposition.
Modeling Conventions	Recker et al. (Yin 2003) discovered that often a set of modeling conventions restricts the use of a grammar to a modified subset that may not exhibit the same characteristics or features as the original 'vanilla' specification.
Voluntariness	Voluntariness reflects whether individuals are free to implement personal adoption or rejection decisions (Walsham 1995), e.g., whether organizations mandate the use of a grammar."

Research Design

In this research, a multiple case study was selected to explore the independent variables of the research model. This is being followed by a series of surveys as part of a field study to test the model.

The **case study method** is used to conduct an empirical inquiry that investigates and explains a contemporary phenomenon within its natural context (Recker et al. 2005; 2006), and denotes the most widely used qualitative method in IS research (Grover et al. 1993; Pinsonneault and Kraemer 1993). In this research case study was used in a both *explanatory* and *exploratory* manner. More specifically, the case study method was used to gain further evidence on the theoretically notions of ontological completeness and clarity of modeling grammars, which are used as independent variables in the research model. Thus, case study was used in explanatory fashion, i.e., it was used to test theoretically generated propositions about the representational capabilities of modeling grammars, and in an exploratory fashion, i.e., extended reasoning was expected to be gained from the case studies with regards of practical implications, work-arounds etc. related to the propositions generated from the representational analysis. The findings gathered from these exploratory studies found their way into the research model as moderating variables, as described above. A multiple-cases study was deemed best as to enable an appropriate level of generalization of the findings and to eliminate single-case bias. Overall, six case sites were visited and a total of nineteen modeling practitioners were interviewed following a pre-established semi-structured interview protocol. The interviewees varied in terms of modeling experience, modeling role and method familiarity, thereby allowing cross-case analysis. The case study phase of this research has been completed, and more detail about its design, conduct, and results can be obtained from, e.g., (Davis 1989; Moore and Benbasat 1991).

While the case study method was used in the early stages of this research to *explore* and *initially test* hypotheses about representational capabilities of modeling grammars that are sought to act as measurement items for the proposed research model (see previous section), the use of the **survey method** is driven by the objective to *test* the resulting proposed model. The survey approach is traditionally a typical method for testing models in IS (Recker and Rosemann 2007). In this study, the survey approach will be employed as part of a field study measuring the hypothesized constructs and relationships. By

conducting two surveys addressing two populations of modelers (EPC and BPMN modelers), the candidate can test and explore the theorized model in a cross-sectional study. A web-based format of the survey instrument will allow for data gathering from a multitude of potential respondents across different regions and cultures, thereby overcoming the bias of restricted contextual settings and supporting potential cross-contextual analyses.

The survey development process, which followed the methodological guidelines of (Byrne 1998), has to date been completed. Information about the survey instrument exercise can be found in . At current, the candidate is in the process of conducting a pilot test of the instrument with roughly 100 modelers from various backgrounds that have familiarity the selected grammars under observation, BPMN and EPCs. The current step is to revise the instrument before “going live”.

Conclusions

This is the first reported study that seeks to empirically measure continuance of conceptual modeling grammars. It will result (a) in a validated model specifying the relative importance of a number of primary variables on the extent of intention to continue using a grammar, and (b) in empirical evidence for the impact that theorized representational capabilities have on continuance of a modeling grammar.

This study draws heavily on existing research frameworks and principles. Hence, the focus of study is restricted by the filtering lenses that the used frameworks and models employ. This means that in the construction of the a-priori model only constructs and relationships have been specified that exist within the boundaries of the selected reference theories. Accordingly, the resulting model may lack other, potentially relevant, endogenous variables that may also pose a contingency effect on the continuance phenomenon. Efforts have been made, though, to account for further contextual variables of importance, which have found their way into the research model. The outstanding data analysis by means of structural equation modeling, e.g., , may well show that some of these variable pose a direct rather than moderating impact on the ultimate dependent variable of interest.

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